iSEE TED Talk: Eco-Edition Renewable Energy

Megan Matthews

Assistant Professor

Civil and Environmental Engineering





Megan L. Matthews, PhD Assistant Professor, Civil and Environmental Engineering

https://matthews.cee.illinois.edu **Matthews** Research Group Postdoctoral Researcher Plant Biology 2019-2020 **NC STATE Assistant Professor** UNIVERSITY **Civil and Environmental B.S. Electrical Engineering** Engineering M.S. Electrical Engineering 2021 - Present Ph.D. Electrical Engineering, 2019



<u>Courses</u>

CEE 340 – Energy and Global Environment CEE 498MPG – Modeling Plants from Genes to Ecosystems

The world's biggest battery looks nothing like a battery



How much clean electricity do we really need? (Solomon Goldstein-Rose)



Fossil fuels are responsible for ~73% of US greenhouse gas emissions (human-caused)

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eia

U.S. greenhouse gas emissions by gas, 2020

total = 5,981 million metric tons of carbon dioxide equivalent (CO2e)



Data source: U.S. Environmental Protection Agency (EPA), Inver of U.S. Greenhouse Gas Emissions and Sinks: 1990-2020, April 2022

Note: Data are CO2e based on 100-year global warming potential. Total is gross emissions.

eia

U.S. energy consumption by source, 2021

total = 97.33 quadrillion British thermal units



Data source: U.S. Energy Information Administration, *Monthly Energy Review*, Tables 1.3 and 11.1, May 2022, preliminary data Note: nonfossil is nuclear and renewable energy.

U.S. energy-related carbon dioxide emissions by source, 2021 total = 4.872 million metric tons

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natural gas

34%

coal

U.S. energy consumption by humans.

29.3 PWh renewables nuclear 🔵 natural gas petroleum coal

U.S. primary energy consumption by major sources, 1950-2021

guadrillion British thermal units

U.S. primary energy consumption by energy source, 2021



April 2022, preliminary data eia

Note: Sum of components may not equal 100% because of independent rounding.

Data source: U.S. Energy Information Administration, Monthly Energy Review, Table 1.3, April 2022, preliminary data for 2021 eia)

Note: Petroleum is petroleum products excluding biofuels, which are included in renewables.

World energy consumption by humans.



Electricity prices for renewables have drastically decreased over the last 10 years, but storage is still an issue.



Notes

Other renewables include geothermal, biomass, biogas and small hydroelectric power. Large hydroelectric and nuclear power are not considered renewable by the state of California. Total supply exceeds demand because some amount of electricity is lost in transmission and some is exported to other states.

Source: California Independent System Operator Credit: Daniel Wood and Lauren Sommer/NPR



Data: Lazard Levelized Cost of Energy Analysis, Version 13.0 OurWorldinData.org – Research and data to make progress against the world's largest problems. Licensed under CC-BY

Renewable energy at UIUC

• ICAP 2020 Objective: Use at least 140,000 MWh/year of clean power by FY25

Current options being used or pursued:

- 1. Solar Energy on Campus
- 2. Wind Energy on Campus
- 3. Power Purchase Agreements for Clean Energy



Image: state stat

Annotations

- FY 2008: Baseline
- FY 2009: Production started at BIF
- FY 2014: Production started at BRC
- FY 2015: bought 20,000 RECs
- FY 2016: Production started at the Wassaja and Solar Farm
- FY 2017: PPA signed with RainSplitter Wind Farm in Nov 2016
- FY 2018: Includes thermal renewables at ARC and the Energy Farm, plus wind and solar power
- FY 2021: includes first five months of Solar Farm 2.0

https://icap.sustainability.illinois.edu/project/use-clean-power

Discussion

- How would your life change if you didn't have reliable access to electricity?
- How do you think we can equitably decrease CO2 emissions while supporting global advancement?
- What do you think needs to happen to meet the goal outlined by Solomon Goldstein-Rose by 2050?
- What are some local, national, or global-scale solutions for transitioning to renewable and/or clean energy sources?